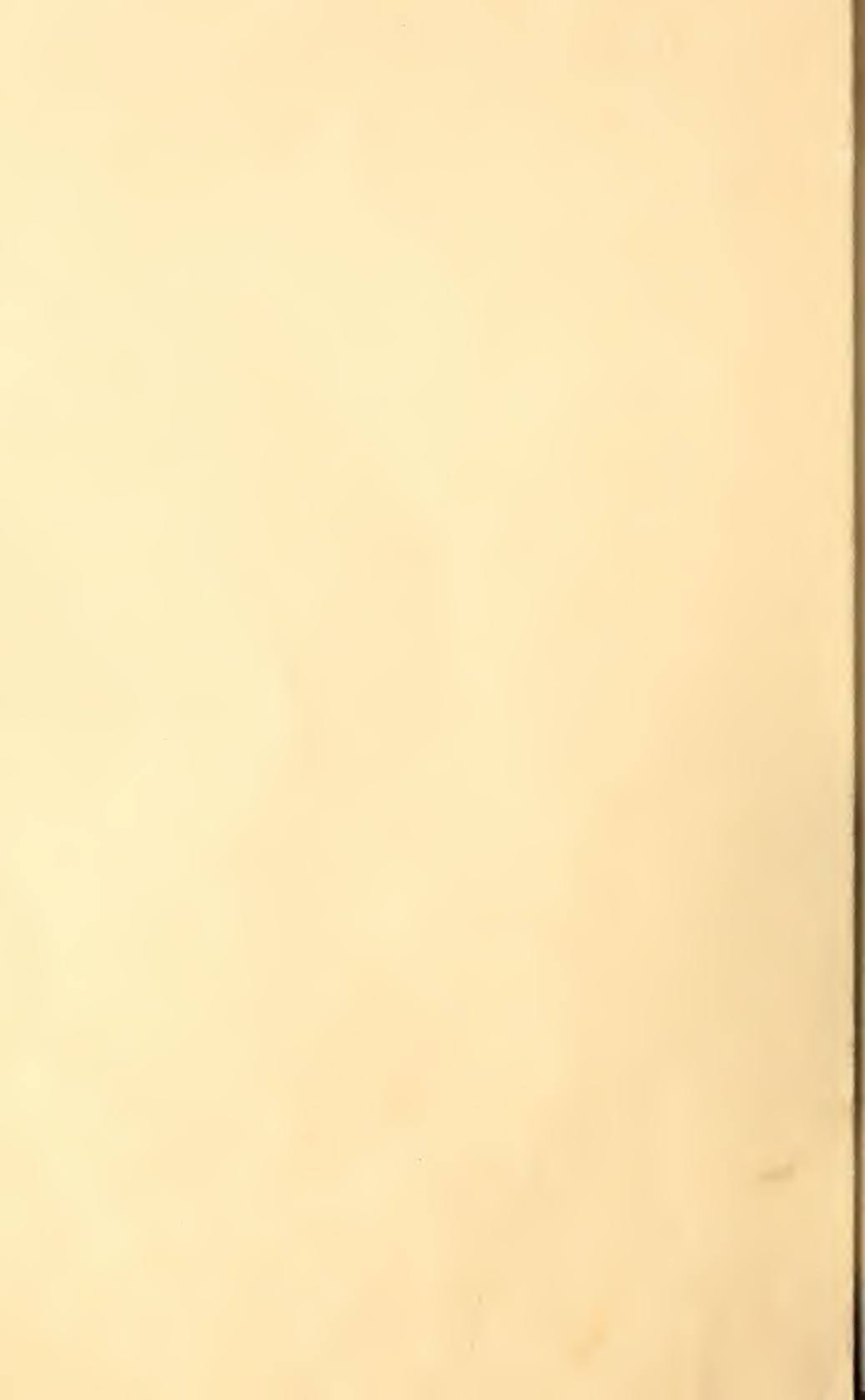


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SPHAGNUM *Moss*

for Seed
Germination



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U. S. DEPARTMENT OF AGRICULTURE

SHREDDED SPHAGNUM MOSS is an ideal medium for seed germination. This has been demonstrated by long experience with several thousand species of plants at the United States Plant Introduction Garden at Glenn Dale, Md.

The use of sphagnum obviates the need for applying chemical protectants to the seeds or the seeding medium to avoid attacks of damping-off; it reduces the need for constant watchfulness and for expert judgment; and it prevents harm from overwatering. If mineral nutrient solutions are applied to it many plants make excellent growth beyond the seedling stage.

The advantages of sphagnum deserve the attention of nurserymen, florists, vegetable growers, amateur gardeners, and other horticulturists and also of plant pathologists.

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SPHAGNUM MOSS FOR SEED GERMINATION

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IN SEED GERMINATION difficulties and uncertainties are often experienced. Chief among these is maintaining uniform adequately but not excessively moist conditions for preventing attacks of damping-off fungi, which destroy young seedlings. The remedies commonly applied are often successful, but they involve considerable labor, attention, and skill. Substitution of sphagnum for soil or sand as a medium for seed germination has greatly simplified seedling production at the United States Plant Introduction Garden of the Bureau of Plant Industry, Soils, and Agricultural Engineering, at Glenn Dale, Md. This method has been used there very successfully for many years with seeds of several thousand species of plants from both tropical and temperate regions, including azaleas, conifers, herbaceous perennials, annual flowering plants, vegetables, palms, cacti, and succulents.

Sphagnum is a moss that grows in some bogs. It is harvested in commercial quantity in Wisconsin and New Jersey and is sold as a dried product by dealers in florists' supplies and other horticultural products.

PREPARATION OF THE SEEDING MEDIUM

Crude sphagnum is long and stringy and does not pack solidly enough to make a satisfactory germinating medium for seed. Adequate shredding is easily done by hand or by machine. Shredding by hand is performed by rubbing the moss through a wire screen having three meshes to the inch (fig. 1, *A*); large quantities are shredded

rapidly in a hammer mill with a screen having 1-inch openings (fig. 1, *B*). When shredded mechanically, the sphagnum should be dry. The finished product may contain some



FIGURE 1.—Preparation of sphagnum: *A*, Small quantities, by rubbing through a three-mesh screen; *B*, large quantities, by a hammer mill with a 1-inch diamond screen.



FIGURE 2.—Freshly sown seed flats covered with panes of glass placed on light wooden frames in background; established seedlings in foreground require no covering.

level; then the surface is firmed until it is a half inch below the rim of the flat. It is then watered thoroughly and allowed to stand for a few minutes. Since the smooth compact surface is favorable to the growth of green algae, an additional layer of sphagnum one-eighth of an inch thick is applied and given a light sprinkling.

Seeds are then sown broadcast or in rows. (See title-page illustration.) If several varieties are to be sown broadcast in the same flat, they can be separated by a thin line of dry sand; this does not disturb the sphagnum, as would the insertion of wooden strips or other markers. Usually no covering is given the seed, though a light covering of the larger kinds does no harm. When the seed has been sown, the surface is given a very light sprinkling—a mist from an atomizer is best—and is then covered with a pane of glass. This may rest on a light wooden frame that fits exactly on the rim of the flat and raises the glass an inch (fig. 2). Tacking one of the glass substitutes on these frames is convenient in obviating the weight and awkwardness of glass. Both light-sensitive and light-inhibited seeds have germinated well in the subdued light under translucent glass substitutes. The flats are not exposed to strong sunlight while covered with close-fitting transparent covers. With the frame cover applied, no further attention is needed for 2 or 3 weeks in a greenhouse atmosphere, a period ample for the germination of many seeds. Ordinarily no additional watering is needed during this period, but in a drier atmosphere it may be required several times before germination. In case of doubt, however, water may be applied, as it does no harm.

When germination is complete the frames are removed. From this time care must be taken against drying out, which may occur before

strands a quarter or even a half inch long, but most of the material should be finer, without being reduced to dust. Living sphagnum makes a very good seeding medium, but is shredded by hand.

Sphagnum may be used in coldframes or in containers with pervious bottoms. In ordinary flats the moss may constitute the whole filling, but if the supply is limited it may be used as a layer an inch thick over a foundation of soil, sand, or sand and peat, provided the foundation drains reasonably well. Old wooden flats showing evidence of wood-rotting fungi should be rejected, as some of these fungi decompose the sphagnum.

The moss is moistened slightly and the flat is filled

the condition is noticed. Fortunately, however, this is a much simpler matter with sphagnum than with soil, because sphagnum tolerates overwatering and in case of doubt water can and should be applied, whereas with soil excessive watering is as disastrous as insufficient watering.

The acidic reaction (about pH 4.3) of the sphagnum might cause some doubt as to the suitability of the material for seeding certain plants. For instance, cacti and succulents are often sown in a compost containing lime sufficient to produce a neutral or even slightly alkaline reaction. Seeds of these plants, however, germinate well in sphagnum and grow for long periods if supplied nutrient solutions occasionally. Addition of lime to the sphagnum has been detrimental rather than advantageous.

During the period of hardening following the removal of the pane of glass, fine metal screen or thin cheesecloth in light wooden frames is useful for covering the flats (fig. 3), as it reduces the rapidity of surface drying and protects the seedlings from attacks by rodents or roaches.

USE OF NUTRIENT SOLUTIONS

Although satisfactory plants for early transplanting may be grown without the use of mineral nutrients, somewhat more vigorous growth may be obtained if a mineral nutrient solution is applied to the sphagnum before the seeds are sown or after they have germinated. The composition of the nutrient solutions for use with young seedlings apparently may vary widely, and various solutions have been tried with excellent results. A useful solution may be made by stirring 1 teaspoonful each of potassium nitrate (saltpeter) and superphosphate in a gallon of water and applying a quantity sufficient to saturate the moss. A solution containing 2 teaspoonfuls of a 12-12-6 fertilizer mixture per gallon has often been used at the Plant Introduction Garden. A satisfactory solution may also be made by stirring 5 or 6 teaspoonfuls of one of the less concentrated complete garden fertilizers, as a 4-12-4 or a 5-8-6 mixture, in a gallon of water. The insoluble residue that may be expected with these fertilizers should be discarded. Nutrient



FIGURE 3.—Flats of newly transplanted seedlings covered with wire screens on wooden frames for protection against drying out.

solutions applied at intervals promote a steady growth of the seedlings and normally are recommended if the seedlings are to be left in sphagnum beyond the cotyledon stage.

RETENTION OF SEEDLINGS IN SPHAGNUM

Withholding nutrients from the sphagnum soon checks the growth of the seedlings and keeps them in an arrested state of development without loss or deterioration—in some cases for a long time. Normal growth may be induced at any time by transplanting out of the flat. This is a very great advantage over soil, in which ordinarily the plants cannot be retained without serious difficulties. Seedlings of *Cinchona* kept for a year in the seed flat have begun growth in normal condition upon application of a nutrient solution (fig. 4). Extra plants of some species can thus be held back in a seed flat for an indefinite period as a reserve. This feature of germination on sphagnum should be useful also in commercial establishments where space is limited and may not be available at the proper time for transplanting. With many species one sowing can supply a succession of transplants for an entire season. Further experimentation, however, is needed to determine the applicability to various species of plants. Another promising feature of the use of sphagnum is that seeds that are too short-lived for successful storage can be germinated and the seedlings held in a retarded condition until desired.

CONTROL OF DAMPING-OFF

The freedom of seedlings from loss by attacks of damping-off is remarkable if sphagnum is used in accordance with the above instructions. The acid reaction of the sphagnum may be a factor in control, but it does not explain the results entirely, as severe damping-off has often been found under identical conditions with soil mixtures hav-



FIGURE 4.—Conditions for small seedlings remain favorable in sphagnum for long periods: A, Flat of seedlings 12 months old; B, plants transplanted from this flat 2 months previously.



FIGURE 5.—Damping-off control through germination on sphagnum. A thin layer of unsterilized soil on the bottom of three plots infected the sterilized soil placed above it and destroyed most of the seedlings; no seedlings were lost on the three plots of sphagnum.

ing the same reaction. The use of sphagnum dispenses with any need for various methods of sterilizing the seeding medium. In no case has chemical treatment of seed for damping-off control been practiced. For the home gardener or the small commercial grower this does away with the use of expensive equipment and with the hazards of indiscriminate use of chemicals. Where needed, however, treatments for seed-borne diseases, as distinguished from damping-off, should be used.

Seedlings of tomato, pepper, petunia, snapdragon, cardinalflower, and scarlet sage were germinated on sphagnum and in soil (fig. 5). Inoculations with damping-off fungi, including *Rhizoctonia* sp., *Pythium ultimum* Trow, *Pythium debaryanum* Hesse, *Fusarium blasticola* Rostr., *Cylindrocladium* sp., and *C. scoparium* Morg., were made singly on the plots. On sphagnum a very few seedlings were attacked at the points of inoculation, but in no instance did the infection spread. In soil most of the seedlings died. When flats were so prepared that the soil plots adjoined sphagnum plots with no barrier between, seedlings on sphagnum were uninjured, but on the adjoining soil few escaped.

TRANSPLANTING

In many cases seedlings are pricked off from the flats at an early stage, sometimes after only 2 weeks, but the time for transplanting is not at all critical unless the seedlings are overcrowded. Removal from sphagnum ordinarily causes less disturbance to the root systems than is usual when they are transplanted from soil. The frames covered with wire screen or cheesecloth, often used during the period of hardening-off of seedlings, are likewise useful for covering flats into which seedlings have been recently transplanted.

GROWING AND SHIPPING PLANTS

Excellent growth for an indefinite period has been obtained with plants transplanted in sphagnum and watered occasionally with nu-



FIGURE 6.—Plants grown in flat of sphagnum for shipment may be separated with enough sphagnum adhering to protect roots in transit.



FIGURE 7.—Sphagnum balls withstand rough treatment and are much more economical to ship than plants potted in soil.

trient solutions. The use of sphagnum is advantageous for growing plants that are to be shipped, because of the light weight of the moss in comparison with soil. It has recently been used extensively for growing plants to be transported by airplane. Plants grown for shipment may be lifted and separated without serious damage to the roots if they have not been standing in the sphagnum for an unduly long period (fig. 6). Plants may also be grown in pots of sphagnum and knocked out for shipment; the balls of sphagnum do not shatter as do balls of soil (fig. 7).

Plants grown in sphagnum do not appear to have any important disadvantages in comparison with those started in soil when lined out under ordinary garden or nursery conditions in the Temperate Zone. Experiments on several types

of soils with a variety of vegetable plants and also several woody ornamentals have shown few differences in growth between the plants grown in sphagnum and those grown in soil prior to lining-out. Care should always be taken to place soil over any sphagnum that may adhere to the roots.

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